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ABSTRACT

Gender differences were examined in results from the holistic model reading tests developed by the Pennsylvania State Department of Education. Patterns of differences were examined and interpreted within the context of previous reading research. Data were collected from the Testing for Essential Learning and Literacy Skills (TELLS) reading tests administered to students in grades 3, 5, and 8 in March 1991. Information came from the item responses of approximately 117,000 third graders, 113,000 fifth graders, and 107,000 eighth graders enrolled in Pennsylvania's 500 public school districts, with some parallel analyses for students in Chapter 1 compensatory education programs. Some statistically significant gender mean differences were found, but their magnitude was slight. This was particularly evident in considering the minimal variance that gender contributes to explaining levels of reading comprehension on the TELLS tests. There is little basis to conclude that gender is particularly favored by explicit, implicit, or extended type test items or by the nature of the test item passage. Similarly, there is little basis to conclude that gender is better either in reported strategy selection or prior knowledge. The Pennsylvania process for developing reading tests and careful passage selection are important factors in understanding why gender differences are minimal. Seven tables present study data, and an 11-item list of references is included. (SLD)

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AN ANALYSIS OF GENDER DIFFERENCES IN PENNSYLVANIA'S 1991 WHOLISTIC MODEL READING TESTS

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Presented at the Annual Meeting of the
Pennsylvania Educational Research Association

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An Analysis of Gender Differences in Pennsylvania's 1991 Wholistic Model Reading Tests

Leonard K. Lock and Leann R. Miller

Statement of the Problem

In 1984 the Pennsylvania Department of Education, Division of Evaluation and Reports, began administering mandatory Testing for Essential Learning and Literacy Skills (TELLS) tests in reading and mathematics at grades 3, 5, and 8. Prior to 1990 the reading portion of the TELLS test was constructed from the perspective that reading is an activity which can be divided into a number of specific skills. Therefore, a "good" reader was defined as a student able to demonstrate a mastery of specific isolated skills. However, within the context of reading comprehension research from the past 15 years, feedback from Pennsylvania educators, and the pioneering work in revising reading assessments done nationally and in some other states, Pennsylvania began to develop new reading tests in 1988. These tests are premised upon the definition that *reading is a dynamic process in which the reader interacts with the text to construct meaning. Inherent in this construction is the reader's ability to activate prior knowledge, use reading strategies, and adapt to the reading situation.* The objective of the present study was to examine gender differences in the test results, to interpret patterns of differences within the context of previous related reading research, and to draw inferences and conclusions regarding why these results were manifest. While statistical significance is addressed, emphases are placed upon the conceptual meanings of these results as well as their implications for test development and reading instruction.

Methodology

The instruments used for this study were the 1991 TELLS reading tests administered to third, fifth and eighth grade students on March 5 and 6, 1991. The information was obtained from the item responses of approximately 117,000 third graders, 113,000 fifth graders, and 107,000 eighth graders enrolled in Pennsylvania's 500 public school districts. Some parallel analyses were also completed on the data of 19,300 third graders, 15,100 fifth graders, and 8,600 eighth graders in Federal ECIA Chapter 1 programs. The Chapter 1 students data are also included as part of the overall analyses as well. No special education students' data were included in any of the analyses. All students read both an informational (or textbook-like) passage as well as a narrative (or story-like) passage. The passages were complete in a chapter or story sense (500-2000 words). There were three types of scored "constructing meaning" (comprehension) items in both the informational and narrative passages: (1) explicit, (2) implicit and (3) extended. The explicit comprehension items required students to identify, locate or confirm information directly stated in the passage. The implicit comprehension items required students to use textual information and prior knowledge to construct meaning and determine conclusions. Finally, extended items required students to respond to and think beyond information provided within the text. Just before reading each of the passages, the students answered prior knowledge items related specifically to that particular reading selection. After reading a passage, students responded to the constructing meaning items for it and then to reading strategies items related to it. These data were analyzed using SPSS-X. Means and other descriptive statistics were evaluated as well as zero order correlation coefficients.

Context of the Study

A number of studies have addressed the topic of gender differences in childrens' reading proficiency and explored possible explanations for these findings. Maccoby and Jacklin (1974) reported on several previous investigations of this concern. Their summarization of this research generally specified a superiority of girls in various verbal and reading skills (also see Asher & Gottman, 1973; Gates, 1961).

More recently, Sabers, Cushing, & Sabers (1987) found that girls' reading achievement was superior to boys in the fifth to eighth grades, with this distinction being particularly apparent regarding higher order thinking skills. However, Sabers et al. tempered these conclusions by stating "the difference between the sexes is not great when compared to the difference within sexes" (p.181). In addition, Steiner, Steinen, and Newman (1981) found that gender differences are minimal when reading is considered as a sex appropriate activity by both boys and girls. Relatedly, Drane et al. (1989) noted that, at least within the scope of their study, cognitive style (i.e., field dependence/field independence) was a more salient variable than gender.

A longitudinal study completed by Martin & Hoover (1987) showed that gender differences in reading are "probably of limited practical significance" (p.82) for those individuals in the average and above average ranges. They also noted that boys' scores were more variable than girls'. Somewhat similarly, in a cross-cultural study, Lummis and Stevenson (1990) found only a few significant differences in reading vocabulary or comprehension achievement. Interestingly, however, mothers' ratings and childrens' beliefs clearly reflected the opinion that girls were superior to boys on these activities.

In the United States on a national level, girls have obtained higher reading proficiency scores than boys on all National Assessment of Educational Progress (NAEP) reading tests. (These tests have been administered in 1971, 75, 80, 84, 88, and 1990.) Further, girls have demonstrated higher mean proficiencies at each of the three age levels assessed --9, 13, and 17. In examining the 1990 NAEP reading assessment it is also seen that there is a higher percentage of girls at the higher proficiency levels. As examples, 65% of the thirteen-year-old girls were able to interrelate ideas and make generalizations, while only 52% of the boys at that age exhibited that level of proficiency. Additionally, 47% of the seventeen-year-old girls in that assessment could understand complicated information, while only 36% of the boys attained that level.

In attempting to better understand gender differences --when they are found-- Bank, Biddle, and Good (1980) reviewed the literature and specified six explanatory hypotheses. These hypotheses are (1) physical maturation, (2) female teacher bias, (3) teacher expectations, (4) reading as a feminine activity, (5) differential response to pupils based upon boys' and girls' behaviors, and (6) sex relevant teaching styles. Those authors suggest that the final four are most supported as possible explanations and conclude "certainly there is no logical reason why the same outcome cannot be produced by different causal processes in different contexts" (p.127). Kincade and Kleine (1990) mention that the varied use of metacognitive strategies as well as the type of information to be recalled are also relevant to understanding gender-related reading differences.

Analyses of Means, Standard Deviations, and Correlational Data

The purpose of this section is to examine if there are TELLS 1991 reading test gender differences by examining means, standard deviations, and correlations. It should be noted at the outset that the correlational results indicated statistically significant relationships ($p < .01$) for nearly all values reported in the following tables. The numerous statistically significant results which follow are not suprising given that increasing the number of observations increases the sensitivity of a test statistic. (Indeed, given the previously mentioned frequencies within this study, the only nonsignificant correlations were .00 and .01.) In this section, positive correlations indicate that females did better than males. It should also be noted that the variance accounted for by any of the correlations indicated below is determined by squaring that particular value. Additionally, the authors report mean data only for the entire gender group, since the study's purpose was not to compare performance levels between those students who are in Chapter 1 reading and those who are not. Finally, the last table presented in this section uses standard deviations as a measure of within-group performance variability. These values are reported only at the grade/passage level for all students tested as well as separately for those in Chapter 1 programs.

Table 1

Third, Fifth and Eighth Graders'
Mean Overall Comprehension Scores and
Correlations with Gender

Grade	Mean Girls	Mean Boys	Correlation All	Correlation Ch1Rd	Max Score
Third	31.27	29.65	.10	.07	42
Fifth	32.98	32.44	.04	.01	45
Eighth	37.60	37.15	.03	-.03	47

Overall, the girls' mean score was higher than the boys' mean in each of the three grades. Further, the correlations of gender with overall reading comprehension scores were low across grades for all students as well as for those enrolled in Chapter 1 programs. Analyses which elaborate the general findings of Table 1 are presented below and continue in the "Differential Item Functioning Analyses" results section.

Table 2

Third Graders'
Mean Passage Comprehension Scores and
Correlations with Gender by Item Type

Passage, Item Type	Mean Girls	Mean Boys	Correlation All	Correlation Ch1Rd	Max Score
Narrative					
Explicit	3.06	2.93	.06	.04	4
Implicit	9.41	9.03	.06	.04	12
Extended	2.56	2.43	.06	.02	4
Total	15.03	14.39	.07	.05	20
Informational					
Explicit	6.32	5.92	.10	.07	9
Implicit	4.89	4.53	.10	.06	7
Extended	5.03	4.81	.08	.06	6
Total	16.24	15.26	.11	.08	22

In first considering the third grade narrative passage, Table 2 shows that the girls performed with higher mean scores than the boys of that grade on all three types of items (explicit, implicit, extended). All correlations were low but positive indicating that (1) gender accounted for little of the variance in performance on these measures, and (2) girls' performance tended to be associated with higher scores, although this association was clearly not strong. A similar pattern of results is seen in examining the third graders' informational passage mean scores and correlations.

Table 3

Fifth Graders'
Mean Passage Comprehension Scores and
Correlations with Gender by Item Type

Passage, Item Type	Mean Girls	Mean Boys	Correlation All	Correlation Ch1Rd	Max Score
Narrative					
Explicit	3.38	3.23	.08	.06	4
Implicit	8.91	8.50	.10	.09	11
Extended	5.65	5.43	.06	.03	8
Total	17.94	17.16	.09	.08	23
Informational					
Explicit	5.91	5.98	-.02	-.06	8
Implicit	7.99	8.21	-.05	-.06	12
Extended	1.14	1.08	.04	.00	2
Total	15.04	15.27	-.03	-.07	22

Inspection of the narrative passage data in Table 3 shows that the fifth grade girls' mean scores were higher than the boys' means on all three types of items. The fifth grade informational passage results were somewhat different. In that passage, the boys' mean was higher than the girls' on the explicit and implicit type items, but the converse was found in examining the extended items. The correlations were again low and similar in magnitude to the third grade data. However, some of the correlations in Table 3 were negative, indicating that on those measures higher mean scores tended to be very modestly associated with boys' performance.

Table 4

Eighth Graders'
Mean Passage Comprehension Scores and
Correlations with Gender by Item Type

Passage, Item Type	Mean Girls	Mean Boys	Correlation All	Correlation Ch1Rd	Max Score
Narrative					
Explicit	3.68	3.58	.07	.05	4
Implicit	9.73	9.47	.06	.03	12
Extended	5.11	4.99	.05	.02	6
Total	18.52	18.04	.07	.03	22
Informational					
Explicit	7.11	7.18	-.02	-.11	9
Implicit	8.36	8.32	.01	-.07	11
Extended	3.62	3.61	.00	-.04	5
Total	19.09	19.11	.00	-.10	25

In reviewing the narrative passage data in Table 4, it is seen that girls' mean scores were higher than boys' on each of the three measures (and total). For the informational passage the boys did better than the girls on the explicit items while the converse was somewhat in evidence for the implicit items. On the extended items of the informational passage the genders performed similarly. The correlations for the narrative passage were again positive and low, i.e., higher scores were slightly associated with girls' performance but accounted for little of the measures' variance. Within the informational passage, the entire groups' correlations were near or at zero. The corresponding Chapter 1 reading students' correlations were low with higher scores being very modestly associated with boys' performance.

Table 5

Third, Fifth and Eighth Graders'
Mean Strategy Scores and Correlations
with Gender

Passage, Grade	Mean Girls	Mean Boys	Correlation All	Correlation Ch1Rd	Max Score
Narrative					
Third	2.24	2.14	.05	.03	3
Fifth	2.10	1.98	.07	.06	3
Eighth	3.17	2.94	.10	.04	5
Informational					
Third	1.84	1.71	.08	.06	3
Fifth	1.45	1.47	-.02	.00	3
Eighth	3.04	2.92	.05	.01	4

Table 5 indicates that at all three grades the girls showed a slight tendency to select the more appropriate reading strategy. The only exception occurred for the fifth grade informational passage. Consistent with the comprehension data correlations, the gender-strategy correlations in Table 5 are low and explain little of the variability in this measure.

Table 6

Third, Fifth and Eighth Graders'
Mean Prior Knowledge Scores and Correlations
with Gender

Passage, Grade	Mean Girls	Mean Boys	Correlation All	Correlation Ch1Rd	Max Score
Narrative					
Third	3.70	3.69	.01	-.03	4
Fifth	3.36	3.32	.03	.01	4
Eighth	3.24	3.39	-.09	-.16	4
Informational					
Third	3.76	3.73	.02	.00	4
Fifth	3.07	3.17	-.06	-.14	4
Eighth	3.76	3.74	.01	-.04	4

Table 6 shows that the boys' and girls' mean narrative prior knowledge scores were similar in the two lower grades, and that the boys' means were higher in the eighth grade. Table 6 also shows that the girls' mean informational prior knowledge scores were similar to the boys' in the third grade, lower in the fifth grade, and again similar on this variable in the eighth grade. Table 6 contains the largest correlation (-.16) found in the study. Even so, less than 3% of the variability on that measure is accounted for by gender.

Table 7

Third, Fifth and Eighth Graders'
Passage Comprehension Standard Deviations
by Gender

Grade, Gender	Info All	Narr All	Info Ch1Rd	Narr Ch1Rd
Third				
Girls	4.11	4.40	4.13	4.47
Boys	4.35	4.74	4.10	4.66
Fifth				
Girls	3.99	4.03	3.48	4.23
Boys	4.08	4.44	3.70	4.42
Eighth				
Girls	4.39	3.13	4.49	4.26
Boys	4.40	3.60	4.77	4.78

In Table 7 the standard deviations for each grade and passage are compared by gender. It is clear that the boys as a group display a greater performance variability regardless of grade or passage. This finding is noted not only for the entire group tested but also for the Chapter 1 reading students. Indeed, only for the informational passage for the third grade Chapter 1 students was the girls' standard deviation higher, and this was only by a marginal amount.

The purpose of this section is to explore how and to what extent each reading comprehension item may have differed by gender across the range of ability levels. Specifically, the focus is upon those comprehension items that exhibited unexpected differential item performance; that is when the genders exhibited differential performance on an item for at least some points of the total score (ability) continuum. The index used for this determination was the standardized p-difference or weighted mean percent difference (WMPD) between the two groups (genders). For discussion and indepth review purposes, a rather conservative flagging criteria of five percent difference was used. A second index, the root weighted score difference which measures variability, was also inspected for unexpected differential functioning results. In all instances, a positive difference indicated a result favoring boys, while a negative difference showed a result favoring girls.

The third grade test

On the third grade 1991 reading test, only two items exceeded the flagging criteria (2/42 of the total items or 4.8%). The first flagged item (WMPD= -.054) barely exceeded the criteria and favored girls. This was an implicit type item appearing in the informational passage. The passage dealt with making scented bath salts and the flagged item was concerned with "what bath salts are probably used for." The gender difference appeared negligible to moderate across the ability range, with the most apparent distinction occurring in the upper range. There was virtually no distinction by gender for this item for children below the cut score.

A second grade three item also exceeding the flagging criteria appeared in the narrative passage and slightly favored boys (WMPD=.054). This extended type item focused on interpreting the statement "one bad bird doesn't make a flock." Item characteristic curve (ICC) inspection indicated that boys did slightly better than girls across the range except for the very lowest scores.

In summary, for the third grade data there were only two items exceeding the flagging criteria, one for each gender and both by only a minimal amount. It is concluded that there is no systematic evidence of gender differences based upon differential item functioning analyses for the 1991 third grade reading tests.

The fifth grade test

On the fifth grade test ten items exceeded the conservative flagging criteria therefore 10/45 of the total items or 22.2% were flagged. Five of these items favored boys and five favored girls. Overall, there were four items in the 5% standardized p-difference range, two items in both the 6% and 7% ranges, and two final items at about 9% and 15% respectively.

All four of the flagged items in the informational passage favored boys. This passage concerned the Chicago fire of 1871. The first such item was of the implicit type and dealt with natural conditions that aided the fire (WMPD= .070). The ICC showed a greater gender difference towards the highest end of the ability level on this item. A second flagged item in the informational passage was explicit and focused on why people fled to a certain point of the city (WMPD= .058). This item showed a rather consistent difference throughout the above cut score range, except at the highest levels where this difference appeared minimal. Below the cut score, the results were inconsistent regarding a gender distinction, with some of these levels favoring boys and some girls. A third flagged item related to this passage concerned the meaning of the word "catapulted"

(WMPD= .151). Except for the lowest levels, this implicit item showed a notable gender difference throughout. This distinction was particularly apparent at the higher ability levels. The fourth and final flagging in the fifth grade informational passage was of an explicit type item (WMPD= .078). That item addressed the purpose of a chart that followed the Chicago fire story. That item exhibited varied but modest differences favoring boys throughout the above cut range. Below the cut, girls were favored in some instances on this item.

Five of the flagged items in the narrative passage favored girls and one favored boys. The story concerned looking for and finding a lost cat. The first flagged item was extended, favored boys, and dealt with what the word "tracking" means (WMPD= .096). This item showed a great deal of gender overlap below the cut and a rather clear difference favoring boys above the cut. Another flagged item required an interpretation of the kind of life (quiet) lived by the story's main character (WMPD= -.050). This implicit item barely exceeded the criteria for flagging and showed only a slight gender distinction throughout the range of test ability levels. A third narrative passsage item that showed unexpected differential functioning was implicit and focused on what was unusual about one of the story's characters (WMPD= -.055). There were slight to modest differences favoring girls above the cut and slight but inconsistent evidence favoring boys below the cut. The fourth flagged item in this passage also favored girls. This was an extended item and addressed an understanding of caring about other people (WMPD= -.055). Only slight/modest differences were noted favoring girls above the cut, with a great deal of gender overlap below the cut. A fifth item in this story favored girls as well (WMPD= -.061). This item required a comparison between the story's real cat and a stuffed cat. It was of the implicit type and exhibited a slight but relatively consistent gender difference across most all the ability range. The final flagged item in the narrative passage also favored girls (WMPD= -.064). It was of an extended nature and focused on whether a story character would be glad to have a cat of his own. The differences appeared slight to moderate in favor of the girls across the range of ability.

In summary, ten fifth grade reading items exhibited unexpected item functioning. As previously mentioned, eight of these were within the 5-7% WMPD ranges and were not considered to be of substantial magnitude. Additionally, it is important to note that across the entire fifth grade reading test an equal number of items favored each gender. The most substantive unexpected differential item functioning finding favored boys. (This item related to understanding the word "catapulted".) It should also be highlighted that six of these ten items fell within the marginal 5-6% WMPD ranges. The authors conclude that the fifth grade reading test did contain items that exhibited a degree of unexpected differential functioning, but that overall neither gender had a statistical advantage beacuse the number and magnitude of items favoring each were relatively equivalent.

The eighth grade test

In the eighth grade reading test, only three items exhibited unexpected item functioning (3/47 or 6.4% of all the eighth grade reading items). In the informational passage two items were flagged, both of which favored boys. The passage dealt with boom boxes which were defined as portable radio/tape players. The initial flagged item related to this passage was explicit and focused on what happens when a tape's speed varies (WMPD= .076). Boys tended to perform modestly better than girls around the cut score, with inconsistent findings below the cut and a result slightly favoring boys in the higher ability range. The other flagged item in this passage was extended and also favored boys (WMPD = .070). The item was concerned with making a selection of box features to get the best possible tape sound. Boys tended to do better on this item except at the lower ability ranges where neither gender was consistently favored. The final eighth grade item that was statistically flagged was extended and from the narrative

passage. Girls did slightly to moderately better than boys across the ability range (WMPD= -.062). The passage dealt with a "phantom" train and the flagged item focused on the story message that doubt is good when it leads us to find out things for ourselves.

In summary, the eighth grade data show that only three items were statistically flagged and that all were in the 6-7% WMPD ranges. Additionally, there was a relative balance with one favoring girls and two favoring boys. It is concluded that the eighth grade reading test exhibited no systematic differences with regard to gender based upon differential item functioning analyses.

Differential item functioning analyses summary

In considering the 1991 reading data across all three grades, the authors conclude, through the use of differential item functioning analysis and related procedures, that no major differences exist with regard to gender. This view is premised on three fundamental observations. First, where differences were noted they appear to be distributed with relative equivalence between the genders. Second, the overall proportion of items exceeding the conservative WMPD flagging value of 5% was only 11.2% (15/134 total items across all three grade levels). Finally, only one of the 134 items administered across all three grades -- less than 1% -- exceeded the more substantive 10% WMPD criteria.

Conclusions

1. While there are statistically significant gender mean differences, the magnitudes of these differences are slight. This is particularly seen when considering the minimal variance that gender contributes in explaining levels of reading comprehension on the 1991 TELLS reading tests.

2. Pennsylvania's process of developing reading tests, including adoption of the wholistic model, obtaining test construction participation from teachers and other experts from across the commonwealth, and careful passage selection are important factors in understanding why gender differences were minimal.

3. In this study, there is little basis to conclude that either gender is particularly favored by explicit, implicit, or extended type items or nature of the passage (informational vs. narrative).

4. In this study, there is little basis to conclude that either gender is better in reported strategy selection or prior knowledge.

5. Similar gender effect magnitudes were found in comparing the entire regular student population results to those of the Chapter 1 students.

6. Consistent with some previous research, boys' scores were found to be generally more variable than girls'.

7. A few specific items indicated gender differences. These items specifed words, ideas, etc., that were apparently more appealing to one or the other gender. Within the wholistic model, student interest in a passage's content appears to be crucial in understanding why gender differences may or may not be found.

8. Consideration of variables other than the test itself are important to more completely analyze any gender differences that may appear (for example, teaching style), because these variables likely influence individual student performances at the classroom level.

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